An Introduction to Forestry for Landowners

Contents

Introduction

The most important part of this booklet is the first 17 pages: an easy-to-read general overview that will acquaint you with important concepts. More in-depth information follows in the appendixes.

This booklet is intended to help you

- Clarify your objectives
- Avoid common pitfalls
- Learn how to achieve your goals
- Learn the concepts and terminology of forestry that will help you when you talk with your forester

Forest Protection

A well-managed forest must first be protected.

Be careful with fire. You are responsible for damage done by your debris fire. You must get a permit to burn debris outdoors from October 15 to May 15. Prescribed fire is a useful tool, but only in the hands of trained and experienced professionals. Even a "cool" fire can damage hardwoods and cause a fungal infection.

Exclude livestock. Grazing animals compact the soil, increase runoff and erosion, kill young trees and damage older trees.

Guard against/control insect and disease problems such as gypsy moths, southern pine beetle, and decay. For information on these problems, see the Forest Health page at www.Tennessee.org/agriculture/forestry.

Use Best Management Practices when logging. BMPs protect soil and streams. Details are given in the Division of Forestry BMP manual. The most important thing is to locate roads and skid trails away from streams and to properly drain them to avoid channeling water into streams. See appendix for information on building and seeding roads and landings.

Tree Biology Affecting Management

Sunlight and tree growth

Tree species vary in the amount of shade they will tolerate.

- Trees that need full sun (shade-intolerant): walnut, red oaks, yellow poplar, green ash, yellow pine, persimmon, sweetgum, cottonwood, sycamore
- Can live in the shade (shade-tolerant): sugar maple, beech, hemlock, blackgum, sourwood, dogwood, holly, red maple, elm, hornbeam
- Somewhere in the middle (intermediately tolerant): white oak, white ash, cherry, white pine, hickory.

Most trees do better in full sun. Note: seedlings of many intolerant species tolerate shade when they are young, but become intolerant as they get older. For instance, just because oak seedlings are present under a stand does not mean they will mature

Many tree species preferred for timber and wildlife habitat are intolerant or intermediate. .

In full sun, intolerant species grow faster than their shade-tolerant competitors. They develop straight knot-free boles because they self prune their shaded limbs. They must have full sunlight to regenerate and grow well. This is one reason patch or clearcutting is so popular among foresters.

Trees in the understory (below the main tree canopy) are usually either of tolerant species or they are stunted. In either case leaving them during logging is unsound from a forestry standpoint – they take up space that could be used to grow useful trees.

Life cycles of trees and forests

Hardwood forests regenerate from seeds, from established seedlings, and most commonly from the roots and stumps of cut trees. Sprouts grow rapidly because they draw on energy stored in the root system.

Trees concentrate their growth upward while they are young, then shift to diameter growth as they mature. Growth slows near the end of their life span. They produce less seed, lose the ability to send up root and stump sprouts, and become more susceptible to environmental stresses. Most timber species in the Mid-south start losing vigor at about age 80 to 100 and die between the ages of 100 and 200.

"Site" means the growing conditions (water, soil, nutrients, solar exposure) at a particular location.

- Good upland sites have deep, moist but well-drained soils, face north to east, and are often found at the base of hills and along streams.

- Good bottomland sites are loamy, deep, well watered but well drained. These sites usually occur on "upper bottoms" or "third terraces"
- Poor sites include ridges, hot dry south and west slopes, shallow and stony soils, convex slopes, poorly drained soils, heavy clay, soils with an iron or clay pan, and soils compacted from agriculture (for hardwoods.)

Site quality for any particular species is measured by the average height it attains at a given age (usually 50 years.) This number is called the *site index.*

Growth rates of tree species (generalized)

Very fast: cottonwood and sycamore on alluvial soils: white pine and yellow poplar in coves, north slopes and other cool moist sites.

Fast: Shumard oak, cherrybark oak and walnut on the best bottomland sites. Loblolly pine on good sites.

Moderate: northern red oak, white ash, walnut, cherry, white oak, sugar maple on good upland sites. Blackgum, sweetgum, wet-site oaks (Nuttall, swamp chestnut, willow) in bottomlands. Upland oaks (white, scarlet, black, southern red) on better sites. Loblolly pine on mediocre sites.

Slow: upland oaks (white, scarlet, black, southern red) on mediocre to poor sites. Walnut, yellow-poplar blackgum on poorer sites; hickory.

Very slow: beech, cedar, post oak, small understory trees.

Number and distribution of trees

Stocking is measured as basal area per acre (BA), which can be visualized as the cut surface area of all 4 ½' tall stumps. A good site can support more basal area than a poor site. Fully stocked upland forests usually have BA's of 60-140. Mature stands on highly productive sites (such as yellow-poplar in mountain coves) might have BA's of 200 or more. BA increases slowly throughout the life of a timber stand.

BA is easy to estimate by holding a penny at arm's length. Turn in a circle, and see how many trees the penny "fits into", with bark showing on either side. Borderline cases are counted "in" every other time. Simply multiply the number of "in" trees by 10 to get the basal area.

Understocked stands (too few trees) waste growing space. Understocking occurs when there are excessive open gaps between trees, or when too many cull trees and undesirable species occupy positions in the overstory. Any forest with less than 60 square feet of basal area per acre of

desirable species is considered understocked. Overstocked stands (too many trees) exhibit retarded, spindly growth.

Desirable spacing in upland oak hickory forests can be estimated by multiplying the average diameter by 1.75. For example, trees in a stand averaging 10" in diameter should be spaced 18' apart.

Genetics

Genetically improved bare-root seedlings available from the Tennessee state nursery can grow up to 30% more usable volume.

Wood and its Value

Timber species and quality

Primary commercial timber species in the Mid-south are red oak, white oak, walnut, ash, hard maple, cherry (locally), yellow-poplar, hickory, and pine. The most valuable logs are straight, long, large diameter, nearly cylindrical, and free of defects. Veneer logs must have almost no defect (even subtle defects detectable only by an expert), and must be at least 13" in diameter inside the bark at the small end. Sawlogs are divided into four sides for grading, and the second worst side determines the grade. Grades 1, 2, and 3 must be 8'-16' long and at least 8" in diameter inside the bark at the small end. These "standard" grades vary among mills:

- Grade 1 – 5/6 (83%) defect-free
- Grade 2 – 2/3 (67%) defect-free
- Grade 3 – ½ (50%) defect-free

Railroad tie logs must be at least 8 ½' long, 10" in diameter inside the bark at the small end, and sound. Culls have no value as timber. Logs of less desirable species often bring only a grade 3 price, regardless of quality.

Timber volume

Usable lumber volume is measured in board feet (BF). A board foot is 144 cubic inches and can be imagined as a 12" by 12" tile one inch thick, or as a 2" by 1" by 6' board, or other combination that equals 144 cubic inches. After subtracting out waste from sawdust and slabs, there is an average of roughly 7 board feet per cubic foot of log volume.

Board foot volume is based on diagrams (log rules) of how mills might saw logs of various sizes. The Doyle rule is most commonly used in the Mid-south. It is fairly accurate for large logs but underestimates small logs. The international rule is more accurate and is used by state foresters. Appendix 27 is an easy guide to measuring your trees in International.

Chipwood, used for paper and panel products, brings a lower price than sawtimber. Chipwood comes mostly from loblolly pine and low-quality hardwoods. It is measured in cords or tons. One fresh cord = 2.675 tons (pine) or 2.9 tons (hardwood).

Timber Management

Any forest management plan has long-term consequences. You can harvest timber white allowing the regrowth of fast-growing, well-formed trees of desirable species. You can manage forests to encourage wildlife and improve aesthetic values.

Silvicultural methods

A variety of options are open to the landowner. These systems have two things in common: they provide sufficient sunlight for desirable species to grow, and they remove unwanted trees. Landowners will have fair success with natural forest regeneration simply by cutting mature hardwoods in groups of a dozen or more trees, including large culls (except wildlife trees). The practice to avoid is diameter limit cutting, which removes the best trees and leaves the "junk". **High grading or diameter limit cutting,** where marketable trees over a given diameter are cut, is not a silvicultural method. High-grading may be less noticeable than clearcutting, but it seldom results in good regeneration. Repeated high-grade logging generally reduces the commercial value of the forest. High-grading has been by far the most common cutting method in the mid-south because it is the most profitable in the short term. There are, however, some situations where high-grading might be appropriate, such as removing a few large over-mature trees from a younger stand, or removing scattered merchantable trees from a streamside management zone.

Patch or clearcutting (removing all trees in an area greater than ½ acre) is used to manage species that require full sunlight (red oak, walnut, yellow poplar, yellow pine etc). Exposure to full sun must be maintained through the sapling and pole timber stages.

This method creates forest edge habitat and produces a variety of nutritious wildlife foods. Relatively **small clearcuts** are best for most species. **Relatively large clearcuts** (say, more than 50 acres) are beneficial but sub-optimal for most wildlife.

Owners of large tracts of land might find that a few large clear harvests are easier to manage than many small harvest areas. Larger harvest areas also require fewer miles of access roads, and once an area is harvested it is left undisturbed for decades. Large openings have less timber edge effect (more limbs on the open side) than smaller openings.

Landowners who employ large clear harvest areas should consider leaving wide (100') streamside management zones containing mature trees along perennial streams. These will accommodate most songbirds even where all upslope areas have been clearcut. Leaving 2 or three den trees per acre will accommodate a number of other wildlife species

Harvesting **small groups** (¼ to ½ acre) of trees can regenerate white oak, ash, red maple, cherry and white pine, which are intermediate in shade tolerance. A few less tolerant species may also regenerate toward the centers of openings. While not optimal for timber production, this method

provides a good compromise between timber, wildlife and scenic objectives. It is well suited to small ownerships.

Individual tree selection management is suited only to trees that reproduce and grow well in the shade. This excludes oaks and most other highly desirable trees in the Southeast. The only timber species in this region that can be grown on a sustainable basis using this method is sugar maple.

Maintaining **two ages** of trees at all times in a given stand is an option in oak forests where scenery and certain wildlife species (squirrels, birds) are important considerations.

Thinning is an intermediate cutting method used to increase growth of the "crop" trees. Thinning can be used in any timber management system at the sapling or pole timber stage. *Thinning does not generate a new forest, and it cannot improve a forest forever. Eventually there must be a final harvest and regeneration of new trees.*

Crop tree management is carefully targeted thinning. The manager identifies trees of good form and species on good sties (crop trees) then frees them to grow faster by cutting some of the surrounding trees.

Butt-log forestry is similar to crop tree management. It can produce veneer logs in a relatively short time on prime sites. Seedlings are planted 13 feet apart. When the crowns begin to close, approximately every other tree (the weakest) is removed. Limbs of the crop trees are trimmed to a height of 17 feet.

Modified shelterwood can encourage oak regeneration on good sites. Understory trees and perhaps 10% of the overstory trees are removed to promote growth of vigorous oak seedlings without encouraging competitors such as poplar. When the oak saplings reach about 10 feet in height, the entire overstory is harvested.

There is no "best" timber management method. Each has its own purpose, advantages and tradeoffs. Methods can be mixed and hybridized. Regardless of the silvicultural method used, the landowner should use Best Management Practices or BMPs.

Determining when to harvest

The important question of when to harvest depends on the landowner's finances and management objectives, current timber markets, tree condition, and stand stocking.

An understocked stand (less than 60% stocked with desirable species) should be harvested in the near future if possible in order to regenerate a new more productive stand. Trees in a well-stocked stand should not be cut too soon or too late. Young sawtimber is worth little but will increase in value rapidly as it adds clear wood to its bole. Healthy trees on good sites will add ¼ to ½ inch

per year to their diameters. This represents a volume increase of 4% to 8% per year. Sawtimber is often sold when it is 16 to 20 inches in DBH. A good stand in this size range should be allowed to grow, since it is rapidly adding premium high grade sawlog volume. In addition, some logs may grow into the veneer class. On the other hand, old sawtimber grows slowly and is eventually lost to storms, insects, diseases, and decay.

Foresters use an increment borer to determine tree age, growth rate, and change in growth. But anyone can tell how a tree is doing simply by looking at it. **Young, fast-growing** trees have pointed crowns with long, thin, tapered limbs – like fishing poles. The bark of a vigorously growing hardwood is smooth for its particular species. **Maturing** trees have thick limbs with tapered ends: their crowns are rounded and stout. **Over-mature** trees have scattered huge branches with short twigs. Their crowns are open and somewhat flat, often with dead limbs in the top. The bark is often rough and fissured.

See appendix 9 for more details about when to harvest hardwood timber.

Selling timber

The commercial value of a stand of timber depends on species, log quality, wood volume, location, access, method of sale, size of sale, method of harvest, current market conditions, and restrictions on harvest. A timber sale is an important event for the landowner and the forest. Financial returns and success at protecting the land, plus the future quality of timber and wildlife habitat produced by the land, are largely determined at harvest time.

Before you sell timber, check with a forester. A State forester can give you advise, prepare a long-term management plan, refer you to loggers and timber buyers, and refer you to a consultant. It is highly advisable to hire a consulting forester to sell your timber. A consultant can give you a thorough inventory of your timber, mark boundaries and timber, prepare a contract, advertise the sale, monitor the harvest operation, help you establish a timber basis, and more. Hiring a consultant almost always gets you more money than you spend on the fee.

For details about how to sell timber and select a logger, see appendix.

Reforestation

Hardwood forests regenerate naturally from stump and root sprouts and to some extent from seed. A good stand can be obtained from this natural regeneration at minimal cost. Factors that influence natural regeneration include the method of timber harvest, species in the original stand, seeds in the litter, adjacent sources of windblown seed, seedlings already present on the site, and whether unwanted stems are killed or "knocked back."

Unwanted stems, depending on size can be deadened by several methods, including cutting and painting with herbicide, girdling, hack/squirting with herbicide, and spot spraying with herbicide.

Planting seedlings is expensive, somewhat technical, and risky, so a professional forester can be very helpful. Seedling survival will be low unless competing vegetation is controlled during the first 10 years. Options include clearing with heavy equipment, spraying with herbicide before and/or after planting, using prescribed fire (pine only), and manually cutting brush around each seedling.

Animal damage is often a problem, especially on good sites. Animals selectively eat seedlings from nurseries because they are rich in nutrients. Little can be done about deer, but voles and gophers can be discouraged by clearing away vegetation and poisoning rodents. County Extension agents can provide advice on pest control.

Trees are planted at a density of 300 to 1,000 per acre. Spacing for pine seedlings is usually 6 to 10 feet, and is often wider for hardwoods. Planting season is December through March. It is best to plant early so the seedlings have all winter to adapt.

Pine can be grown profitably on mediocre sites such as old fields and broad ridges. Limit hardwood planting to very good sites and to wildlife enhancement. Old fields are not good sites for hardwood planting because hardpans caused by farming and grazing inhibit root penetration. Growing intermingled blocks or strips of pine and hardwoods on appropriate sites will reduce disease and insect risks, provide wildlife and aesthetic benefits, and hedge against future shifts in demand.

Management objectives and markets should be carefully considered before planting and/or using natural regeneration. For example, tax-deferred return in areas with good markets may be 12 to 14% per year over a 20-year crop rotation. On the other hand, some areas lack good markets for pine, but markets exist everywhere for hardwood sawlogs.

Government cost share programs may be available, but they change frequently. Check with your local Division of Forestry area forester. Also, you can deduct the first $10,000 of reforestation costs the first year and the remainder amortized over 8 years (see appendix).

See the Division of Forestry seedling catalogue/order blank for a listing of available species. Early orders (as soon as the new catalogue comes out in summer) have the best chance of getting first choice of species.

Managing for Wildlife Habitat

Forest management can be tailored to benefit any species or groups of species. Timber harvest can serve as a valuable wildlife management tool, especially when the following principles and techniques are taken into account.

In general, maintaining a ***diverse habitat*** with a mix of forest, small openings and "edges" between them will benefit deer, rabbit, turkey, raccoon, quail, grouse and many non-game animals.

Management techniques

Create openings in the forest to provide more sunlight, which in turn produces accessible foods. Openings can include **timber harvests**, seeded **log landings and roads**, long, narrow **game strips** in unbroken forest, and permanent wildlife **food plots** (at least ¼ acre in size).

"Feather" forest edges (thin the forest near openings to encourage a brushy edge).

Leave buffers along streams: minimum 50' uncut buffers along each side of perennial streams, and twice that distance along trout streams and in areas managed for songbirds. **Swamps, bogs and other wetlands** demand special consideration.

Leave 1 to 3 den trees per acre and as many large **dead trees (snags)** as possible to benefit squirrels, raccoons and birds. Leave a few other trees in a clump around each den tree. **Snags** should be at least 12" diameter and 10' tall. Create snags where few are present by girdling commercially undesirable trees.

Build nest boxes for squirrel, bats, and certain birds if den trees are lacking. Patterns for constructing nest boxes are available from Tennessee Wildlife Resources Agency, 1-800-624-7406.

Thin crowded stands to increase tree growth, health and mast (food) production.

Establish stands of **native warm season grasses** for big game and game birds.

Use prescribed fire to maintain food plots and native warm season grass plantings, and to improve habitat in pine stands (older than 10-15 years).

Exclude livestock from the woods. They compete with wildlife for browse, compact the soil, and damage young trees.

Make piles of brush and limbs after timber cutting to provide cover for rabbit, quail and songbirds.

Plant evergreens to provide hiding cover and winter shelter for many wildlife species.

Allow **brush and trees** to grow along fences, and provide **"headquarters areas"-** dense brush thickets - to provide cover for rabbit, quail, etc.

Manage for oak and other hard-mast-producers by cutting other competing species around them. Conduct periodic timber harvests to regenerate oaks that are past their mast-producing prime in order to assure a future acorn supply. Sawtooth (Chinese) oak, available from the State Seedling Nursery, and blight-resistant chestnut, which can be ordered from several commercial nurseries in Tennessee, are heavy and consistent mast producers.

Plan ahead for the gypsy moth, an invasive pest that can devastate oak forests on dry sites. Strive for a diverse, healthy forest. Yellow poplar and sugar maple are avoided by the gypsy moth.

Protect endangered species on your land. These usually occur in small, unusual habitats near water and on rock outcrops. Information can be obtained from handbooks available through the Forestry Division.

For more detailed information about managing for specific species, see appendix.

Leasing to hunters

Landowners can generate income and get some help in policing and protecting their land from trespass and vandalism by leasing it for hunting. See appendix 22.

Enhancing Forest Beauty

Most landowners place a high value on the beauty of their woods. The natural beauty of the forest can be enhanced. Wildlife/ timber management can contribute by increasing diversity and interest.

Variety (many species and ages of trees, contrasting stands, openings.) Diversity in vegetation also promotes diversity in wildlife.

- Conduct small timber harvests using different techniques: small "clear-cuts" (all species), two-age cutting (oak), single tree harvest (sugar maple))
- Plant trees and shrubs, including some evergreens
- Leave snags and den trees
- Leave trees along streams and bluffs
- Maintain small food plots
- Create gradual transitions from forest to openings

Special features, points of interest: ponds, springs, streams, wildlife observation blinds, old house sites, cemeteries, bluffs, caves, shady coves, open park-like stands, overlooks, vistas, big interesting trees.

- Leave trees near water
- Build trails for access
- Install park benches
- Locate wildlife viewing points at forest edges and streams
- Fertilize, lime and remove competitors around selected trees to increase their growth;
- Develop park-like stands by favoring maple, beech, basswood and white pine (on good sites); prune branches (to 17' to increase timber value); under-burn pine stands

"Placeness" and **privacy.**

- Plant hedges, (especially curving evergreen hedges)
- Maintain contrasting types of forest and openings
- Lay out curving trails that lead from one "place" to another
- Locate trails and roads along boundaries between different types of vegetation to accentuate their differences
- Build "places" around special features
- Use converging and diverging lines of vegetation along trails to draw attention into and out of the woods, or to a feature.
- Use terrain features: hilltops, north slope in summer, south slopes in winter

Special places are a key to enjoying your forest. You can enjoy them while reaping the benefits of more intensive management (wildlife habitat improvement, timber production, leasing) elsewhere on your property.

Wildflowers

- Many species will colonize if their habitat is provided.
- Native wildflowers can be planted in appropriate sites.
- Threatened and endangered (T&E) plants should be purchased *only from a nursery with a T&E license.*
- Bogs and streamsides sometimes harbor unusual wildflowers.

Plant favorite trees, shrubs and flowers around ponds, clearings, along trails and near park benches.

Trees with spring flowers: redbud, dogwood, sourwood, catalpa, paulownia, serviceberry, tulip poplar, crabapple, hawthorn, buckeye, yellowwood, black locust, red maple.

Fall color: ash, blackgum, poplar, sassafras, sugar maple, red maple, pignut hickory, dogwood, sourwood, sumac and sweetgum; oak varies considerably. Pine resin adds fragrance to fall air.

Winter: holly, pine, cedar, hemlock (green, windbreaks); crabapple, hawthorn, dogwood (berries) sycamore (bark, fruit), sassafras and other trees with interesting branches

Where timber is harvested:

- Clear harvest only small areas.
- Consider creating a two-age stand.
- Plan and flag in roads and skid trails to minimize damage to soil and residual trees.
- Cut low stumps.
- Mark "bumper trees" at bends in skid trails to protect other trees as logs are dragged past (remove the bumper trees last.)
- Chop or pile logging debris. Piles of branches provide cover for wildlife.
- Leave trees along roads, ponds, springs and streams. Trees left along roads can be cut after new trees have grown.
- Grade and re-vegetate roads and skid trails.
- Don't log when the soil is wet
- Mark anything you want left or protected.
- Specify all protection measures in a logging contract.
- Choose a logger with a good reputation.
- Mule logging and feller/buncher machines might disturb the ground less than conventional skidders. Ask your consulting forester.

After one growing season, the harvest site will be covered with natural seedlings.

Income Taxes

Forest tax regulations are complex and subject to change. Many IRS agents and accountants are unfamiliar with them, so it is usually up to landowners to educate themselves. The following brief checklist is intended only to alert the reader to certain important points. More detail on important tax topics is found in the appendixes.

It is important to establish a cost basis and keep it current. Cost basis is your investment in the timber. You can deduct the basis from your income when you sell the timber. Having a basis also allows you to claim a loss if the timber is destroyed suddenly and unexpectedly. A forestry consultant can help you establish a cost basis, even if the land was purchased years ago.

Capital gains are taxed at a much lower rate than regular income, and are exempt from the self-employment tax that must be paid on timber sales reported as ordinary income. You can also deduct your basis in the timber when it is sold, thus lowering your taxes.

Decide on your IRS status as a timber seller.

- Hobbyist
- Investor (many absentee owners fall in this category)
- Owner of a trade or business in which you do not actively participate
- Owner of a trade or business in which you actively participate

Each has advantages and disadvantages, depending on your situation. Active participation is the most desirable status for most taxpayers, since it allows for you to deduct timber management costs against income from any source. The IRS has six tests to help determine whether your management is active or passive:

1. you participated more than 500 hours
2. your effort was "substantially all" the activity
3. you did more than 100 hours, which was more than anyone else
4. all related activities of more than 100 hours that don't of themselves meet the material participation test add up to more than 500 hours
5. you materially participated in five of the last 10 years
6. all facts & circumstances show you materially participated (not advisable)

Deductions. Many costs of owning, managing and selling timber may be deductible from your gross adjusted income, depending on your tax status and the nature of the expense. **Good records are important** for you and your tax accountant in claiming and defending deductions**.**

Reforestation tax credit and amortized deductions. If you are growing timber for sale, you can deduct up to $10,000 the first year and amortize the remainder over the next 8 years.

Greenbelt status, obtained through the county property assessor, will reduce your property taxes.

Keep in mind that it is most important that you establish a timber basis, know your filing status, and know what you can deduct. For more detailed information about taxes, acquaint yourself with the material in the appendixes, see the following web sites and discuss with your forester and your accountant.

National Timber Tax Web Site: www.timbertax.net
Tax Tips for Forest Landowners: www.r8web.com/spf/
IRS publications and forms: www.irs.ustreas.gov

Management Planning Checklist

Obtain a map. Sources: property assessor's office, NRCS (aerial photos), Tennessee Department of Environment and Conservation topographic images, and on the web at www.topozone.com, www.terraserver.com, and www.mapquest.com. Draw in boundaries and streams.

Survey and mark boundaries.

Be sure you have clear title to the timber on your land.

Determine goals: land value appreciation, cash from timber harvest, investment in future timber harvests, wildlife, hunting, leasing, beauty, college tuition, etc.

Assess finances and length of your planning horizon.

Keep records of activities and expenses.

Evaluate threats from insects and diseases.

Assess and map quality of sites in general terms (rich north cove, dry south-facing knob, etc.)

Obtain a current inventory of timber volume, species, and grade.

Establish a timber cost basis.

Map timber stands; determine stocking levels, vigor and growth rates. (You will probably need a forester's expertise for this.)

Note any trees/stands about to grow into a more valuable grade.

Assess regeneration potential of proposed timber harvest areas (a forester's expertise is needed)

Identify non-forested areas suitable for tree planting.

Identify site needing extra protection, such as streamsides, high quality trees, and stands at risk from nearby timber harvesting.

Decide which wildlife species to manage for and which methods to use.

Decide on silvicultural methods compatible with the site, species, and your objectives.

Again, keep good records for your tax accountant.

Appendixes

Appendix 1 – Road construction

Roads can vary from a simple dozer trail to a graveled, cross-drained all-weather road in rough terrain. The following information should be sufficient for average circumstances. Special skills and experience might be needed in constructing roads in more difficult situations.

Specifications for road construction should be written into contracts so that the roads are an asset to the property rather than a liability.

The first step is to flag a trial road centerline. Keep the grade below 10%. Stay as far from streams as possible. Do not put the road directly on a ridgetop, but on the ridge shoulder where it can drain. Critical "control" points might determine the route of the road. These could include wet areas, creeks, rock outcrops, or a location for a switchback. If switchbacks or similar sharp turns are needed, construct them on a 60-foot radius to the centerline.

The initial dozing should have few cuts and fills and might remove as little as six inches of soil. Push debris to the downhill side, where it will catch sediment that washes off the road.

On subsequent cuts install broad-based dips every 140 to 300 feet, depending on the steepness of the road grade. Broad-based dips are built into the road grade by backsloping at 3%. These dips are in effect a rolling of the road grade. Dips and wet areas should be armored with 3" gravel.

Outslope or inslope the surface at 3% (1/4 inch per foot.) This will remove water from the surface and prevent erosion. On flat ground, crown the road at 3%. Inslopes should be used where a slippery surface could create a safety hazard. Culverts or open-topped log cross drains will be needed to drain ditches of insloped roads.

Make the final road surface at least 12 feet wide. Balance fills and cuts, and try to minimize disturbance. This will save money and reduce soil movement. Construct several months in advance to allow fill to settle. Do not use topsoil as fill.

Avoid constructing in wet weather. Avoid crossing streams. Where streams must be crossed, do so at a right angle. Refer to state Best Management Practices guidelines for appropriate crossing structures. Where the road follows an old road grade, disturb the surface as little as possible.

Flag skid trails prior to logging. Locate them on the contour to the extent possible. Keep the grade below 10% (short stretches of up to 30% are acceptable.)

Water bars should be installed on skid trails and temporary roads when the sale is finished. They should be 8-12 inches deep and angled to the downhill side about 30 degrees. Spacing of waterbars depends on slope and soil type, but a general guide is:

5%	125′
10%	80′

15%	60′
20%	50′
25%	40′

Sow exposed soil to grass, using a rate of 30-40 lbs./ac fescue and 60 lbs./ac wheat between early March and mid-April, or mid-August to mid-October. Late sowing (May – early June) can be done with 30 lbs./ac sericea lespedeza.

Appendix 2 – Seeding Roads and Landings

Seeding log landings, skid roads, retired roads, and road banks can

- Protect valuable soil from eroding
- Protect water quality in streams
- Improve the looks of a logging site
- Create prime wildlife cover and feeding areas for turkey, quail, grouse, rabbit and other animals
- Create travel lanes for wildlife
- Stabilizes roads for recreational use

Rip compacted areas with a single-shank subsoiler (50hp tractor required), then seed using a mix of any of the following (be sure to maintain proportions that add up to give full coverage):

Perennials

Fescue	20 lb/ac mid-August through mid-October *and*/*or* mid-February through mid-May
Orchard grass	18 lb/ac mid-August through mid-October *and*/*or* mid-February through mid-May
Clover	4 lb/ac mid-February through mid-May
Lespedeza	12 lb/ac mid-February through mid-May
Perennial rye	25 lb/ac mid-August through mid-October *and*/*or* mid-February through mid-May
Crown vetch	5 lb/ac mid-August through mid-October *and*/*or* mid-February through mid-May
Prairie grasses	7-10 lb/ac mid-May through mid-June
Partridge pea	14 lb/ac mid-March through mid-May

Annuals

Sorghum	45 lb/ac mid-April through mid-June
Wheat	50 lb/ac mid-August through mid-October *and*/*or* mid-February through mid-May
Timothy	8 lb/ac mid-August through mid-October *and*/*or* mid-February through mid-May
Buckwheat	40 lb/ac mid-August through mid-October *and*/*or* mid-February through mid-May

Keep seed from washing away.

- Pre-plan roads so they are not too steep, and flag them. Good roads are a permanent investment that can be used far into the future.
- Maximum grades might be 10% in soils that are relatively resistant to erosion, such as clays and cherty soils, and only 3% or so in highly erosive soils, such as West Tennessee silts and silt loams.
- Be sure roads are well drained so that water can flow off the road rather than down it. A very effective drainage method is to "out-slope" the road grade.
- Take advantages of terrain features that can serve as natural drains.

After timber harvest is complete, lime (~ 2 tons per acre) and fertilize (~ 500 lb./ac 6-12-12 or 250 lb/ac 12-24-24). Disking the seed in is optional. If the soil is loose, dry and dusty, rain will mix the seed in. Sticks and other logging debris left on the site will help hold the seed and prevent erosion.

Appendix 3 – Midstory Removal – Regenerating Oak on High-quality Sites

Regenerating oak on highly productive sites poses a problem because faster growing species, especially yellow poplar, overtop and shade oak seedlings and sprouts. Oaks tolerate and grow in moderate shade for the first 10 years or so of life, but if they remain in the shade they will become stunted or die.

The objective of midstory removal is to create the light conditions that encourage oak advance regeneration to grow faster than competing species.

The first step in regenerating oak on good sites is to ensure that oak seedlings and sprouts are already present. The next step is to remove the midstory so that enough light is let through to allow these seedlings to grow vigorously, but not so much light that poplar and other competitors take over. The midstory is composed of trees whose tops do not reach the height of the main canopy. Midstory species can include sapling-sized red maple, dogwood, hickory, hornbeam, sourwood, black gum, and beech.

Do not remove any trees from the main canopy. This would let in too much light and encourage unwanted competition. Likewise, do not remove any midstory tree that would uncover a gap in the canopy.

Midstory trees should be killed with herbicide applied by frilling or by basal streamlining. To frill, chop around the tree trunk and apply herbicide to the wounds. Basal streamlining is spraying a stream of ground-active herbicide around the base of each tree. Use appropriate herbicides labeled for each type of application.

Remove overstory trees in one or more cuttings once the oak gets big enough to stay ahead of competing seedlings. This is usually five to ten years after midstory removal, when the seedlings are about 10 feet tall.

Appendix 4 – Crop Tree Release

Crop tree release (CTR) provides a way for landowners to increase the growth rate of trees, reduce the time needed for trees to reach marketable size, increase timber quality, improve wildlife habitat, and at the same time protect and improve the appearance of the forest.

Select good sites – deep, loamy, well-watered but well drained - where your efforts can pay off. Good sites are usually found on well-drained bottomlands, along streams, in coves, on north and east slopes, and on concave landforms. Use NRCS soil maps and/or look for

- presence of tree and understory species usually found on good sites
- tall straight tree trunks
- smooth, thin, tight bark on young timber

Determine if the trees are big enough (at least 4" diameter breast height).

Define your objectives: timber? wildlife? appearance?

Group species according to their desirability for meeting the objectives. A suggested list:

Timber – desirable:
oak, tulip poplar, ash, cherry, walnut, paulownia

Timber – acceptable:
maples, persimmon, hickories, beech (if sound)

Timber – unacceptable:
Blackgum, sweetgum, buckeye, sourwood, hollow beech, locust, elm

Desirable for wildlife:
Oak, beech, persimmon, maple, dogwood, white pine, blackgum, hickories (except bitternut), black walnut

Desirability for wildlife depends on the needs of the wildlife species you want to benefit.

Managing for a diversity of tree species has several advantages: it benefits a wider variety of wildlife, reduces susceptibility to insects and diseases, and allows for changes in the timber market.

Choose crop trees. Walk through the woods, stopping every 35 feet. Imagine you are in the center of a 35' square, then determine which tree in that square, if any, will be the crop tree, and mark it. Upon reaching the forest boundary, start another line of plots; continue until all the land is traversed and crop trees are marked.

Criteria for timber crop trees:

- desirable or acceptable species
- good form – not bent or forked in first 17 feet
- clear trunk with few knots
- top is part of upper forest canopy

- no big dead branches, holes or wounds
- appears to be fast growing – branches in crown reach upward like long slender fishing poles

If there are less than 18 crop trees per acre, CTM may not be justified. Consider harvesting groups of trees and regenerating the forest.

If wildlife and aesthetics are objectives, then trees meeting those needs could be considered as crop trees even if they are not suitable for timber.

Deaden all trees with crowns touching the crop tree crowns (on at least three sides). Do not deaden other trees – they will help protect crop tree trunks from wind damage and epicormic branching (sprouting of new branches from the trunk).

Trees can be deadened either by girdling with a chainsaw (cut two rings around the trunk at least 6' apart and at least ¾" into the wood) or by frilling with an ax and applying a solution of appropriate herbicide (Accord, Garlon, Tordon). Deadened trees will provide snag habitat for wildlife. It is normally not feasible to remove these trees for sale.

Tree growth and wildlife food production should increase substantially following crop tree release (studies show roughly 40 to 80% greater diameter growth). The increase in dollar value is even greater, due to increases in log grade.

Other cultural practices Grapevines can damage trees by blocking sunlight and by breaking the tops during ice storms. Deaden any vines you don't want for wildlife by cutting vines and applying a 25% solution of glyphosate (brand name Accord or Roundup).

Pruning limbs up to a height of 17 feet will improve log grade more quickly.

Fertilizing with nitrogen and lime increases growth substantially. Scatter between 3 and 9 lbs. of ammonium nitrate (2-6 lbs. urea) over a 25-foot diameter circle centered on each crop tree during the first March after release.

Harvesting groups of a dozen or more crop trees will open up the forest enough for new trees to grow. Harvesting groups of trees also reduces damage to standing timber. Non-crop trees in the harvest area should be deadened.

Appendix 5 – Selling Timber

Following these steps should assure a landowner of a fair price, protection of the land, proper tax treatment, and freedom from legal problems.

Keep good records for tax purposes and educate yourself about federal timber taxation. Most tax preparers and many IRS agents are unfamiliar with the rules, but most foresters are. Excellent web sites on this subject include
www.southernregion.fs.fed.us/spf/taxtips/
www.web.com-taxtips
www.fnr.perdue.edu/ttax
www.irs.ustreas.gov
www.fs.fed.us/spf/coop/Forest%20_Tax_%20Guide31201.pdf

Get professional help. A *State area forester* can give you valuable advise, planning assistance, and a list of consulting foresters. *Consulting foresters* will work on your behalf to get top dollar while meeting your other objectives. The cost of the commission is well worth it.

Know what you have in terms of timber volume and quality. Quality (grade) makes a tremendous difference in price received. Only an expert can accurately determine grade.

Decide when to sell. Over the past few decades timber prices have risen on average about 5-10% per year, depending on grade and species. However, the timber market is cyclical, so try to wait out the lows and sell when prices are up. Also, consider the maturity of your timber. Is it too young or too old? Young timber is just entering its most productive years, but it is not yet worth much. Old timber may actually be losing volume.

Circumstances may sometimes dictate that you harvest timber immediately to salvage damaged timber and reduce the threat of loss from insects, disease or fire.

Consider other objectives and make a long-range plan for your land. Timber harvest is a great opportunity to improve your woods for decades to come. Prior to harvest, decide on important questions like regenerating the next stand and protecting your land's productivity.

Survey and mark boundaries to avoid disputes.

Decide on a sale method. You can sell by shares, pay-as-cut, or lump sum. The latter is usually best for the seller *when done by sealed bid* because competition generates higher prices. For a few sellers, pay-as-cut can offer decided tax advantages by allowing capital gains treatment. Negotiating a price and payment method may be appropriate where special sale conditions limit the number of interested and qualified bidders.

Invite bids and conduct a show-me tour. A consultant can handle this for you. Bid invitations should include a location map, date of tour, date/time & location of bid opening, terms of payment, timber volume summary, bid form, information about the performance bond, and a statement of the seller's right to refuse bids.

Open the bids & negotiate the contract with the highest *acceptable* bidder. Collect any deposit or performance bond agreed upon. Prepare a copy of the contract for the buyer as well as for yourself.

Prepare a contract to protect both buyer and seller. One of the most important elements in timber sale contracts is a verification of the seller's legal ownership of the timber to be sold and its freedom from liens or other encumbrances. The contract should also include a description of the timber for sale, the selling price, terms of payment, which timber will be cut and not, time allowed to cut and remove timber, and a requirement to follow Best Management Practices. Other provisions can be added, but these may restrict bidders and lower the price paid. Your forester or Extension agent can supply a sample contract

Inspect the logging operation often to be sure that the contract provisions are followed. A consulting forester can do this if desired.

Follow through by retiring the sale area and taking steps to assure future productivity. For example, install water bars and seed skid trails and landings, if not done by the contractor, and cut or deaden residual undesirable trees.

Appendix 6 – Advertising a Timber Sale

(Excerpted from Oklahoma Extension Facts F-5035.)

There are several steps to follow in preparing a timber sale notice. You must have accurate, reliable information and you need to send it to as many prospective bidders as possible. A professional forester can assist you with a list of reputable timber buyers. For additional advertisement of your timber sale, place an add in several area newspapers directing interested buyers to contact you for a complete description of the sale. A timber sale notice should include the basic information that will become part of the timber sale contract including:

- **Your name, address and phone number;** or the name address and phone number of the forester managing the sale.
- **The location of the timber to be sold.** Include a map and legal descriptions and directions for locating the area. Also, include how the sale boundaries will be marked.
- **A description of the trees or logs to be sold.** Include volume by species, diameter classes and sawlog grades if appropriate.
- **Type of bid you are expecting.** Either lump sum of scaled sale.
- **Type of sale.** Either sealed bid or unit sale.
- **Times when potential buyers can visit and inspect the timber sale area.** Usually, one month is allowed from the time notices are sent until the bids are opened.
- **The date, time and location when written bids will be opened.** Include how the successful bidder will be selected and notified.
- **Whether or not a down payment is required to bind the offer when the contract is signed.** An amount of 5 to 10 percent of the bid price is normally required.
- **Any limitations or special ownership considerations on the sale.** Such considerations include implementation of Best Management Practices. Harvesting deadline, restrictions on access, considerations when loggers cannot operate (i.e. excessively wet conditions), streamside management zones or buffers, snag or cavity leave trees, etc.
- **The requirement for a performance bond.** A performance deposit is an amount of money over and above the sale price (usually 10 percent of sale price) posted by the buyer when the contract is signed and held in escrow by the seller. The bond's purpose is to ensure that the buyer abides by the terms set forth in the contract. The performance deposit should be refunded immediately after the sale is completed and contract requirements are met
- **Evidence that the logger carries workman's compensation insurance** for all members of the logging crew and has adequate liability insurance. Workman's compensation insurance will avoid possible legal complications if a logger is injured on your property. Be sure to see the logger's workman compensation insurance and liability papers to make sure they are in effect.
- **Statement of the right to refuse all bids.**

You should also specify the length of time that will elapse before the successful bidder is notified, usually within seven days after the bids were opened. The amount of time the successful bidder has to respond should also be included. Normally, ten days are allowed for a yes or no response.

Appendix 7 - What to Include in a Timber Sale Contract

1. Name and address of buyer.
2. Date contract is executed.
3. Description of the timber: species, size, marking.
4. Location and legal description.
5. Statement that states seller's ownership and right to convey; should include title abstract and title insurance.
6. Provision for buyer's entrance into and exit from the property.
7. Statement that logger must stay within the marked area.
8. Care required of buyer toward property of seller.
9. Penalty for cutting non-designated timber and not cutting designated timber
10. Method of logging to be used.
11. Statement that buyer will use Best Management Practices.
12. Fire protection clause.
13. Method and terms of payment, including down payment
14. Duration of agreement (usually 12 to 24 months).
15. When logging will begin
16. Requirement that buyer notify seller of start and stop dates (7 to 10 days notice is often required).
17. Utilization standards: stump height, top diameter, etc.
18. Statement of who will suffer the loss if timber is stolen or destroyed.
19. Provision for or against assignment of contract to a third party (subcontractor).
20. Restriction of when logging can be done.
21. Landowner's right to inspect logging site and suspend operation if buyer is violating provisions of contract.
22. Detail steps buyer must take to be released from contract.
23. Penalties for non-performance, including setting up and escrow account.
24. Provision that frees seller from liability for injury, death or damage caused by the logger.
25. Statement that logger must show proof of having workman's compensation coverage and is not an employee of the seller.
26. Provision of a performance bond (usually 5 to 10% of sale price).
27. Provisions for logger's responsibility for repair of site: litter, seeding, clearing landings, repairing roads, etc.
28. Clause allowing for arbitration in case buyer and seller cannot agree on and issue.
29. Provision for or against renewal of contract.
30. Statement that any changes to the contract must be signed, dated and witnessed.
31. Signature of both parties.
32. Notarization of contract, preferably with two witnesses' signature.
33. Recording of contract at the county courthouse.

If your land is financed, the timber is probably covered by the mortgage and is part of the lender's collateral. You should work out an agreement with the lender prior to the sale. The lender could require that the proceeds be applied to the loan. The arrangement should be in writing.

You should consult your tax accountant (and/or consulting forester) concerning filing status and capital gains eligibility prior to planning the sale. If you sell timber frequently (every five years or so), you may be

considered “in the timber business” by the IRS; as such, you must sell in accordance with IRS Code 631(a) and (b) to retain capital gains treatment, and must pay self-employment tax.

Appendix 8 – Selecting a Logger

It is important for a landowner to select the right logger, one who:

- Has a reputation for honesty and good work
- Uses environmentally sound practices
- Will abide by the provisions of your contract
- Has the right equipment and skills to do the job
- Has proper safety equipment, places a high priority on safety and carries insurance

It is also important for the landowner to understand the pressures a logger faces:

- A huge investment in equipment,
- Breakdowns
- Highly competitive timber purchasing
- The risk that timber will not have the quality anticipated
- Shifting markets
- Wet weather, a high risk of injury, high insurance costs, and competition from less scrupulous loggers who use substandard practices or don't carry workers' compensation insurance.

The "good ol' boy" method is not the best way to pick a logger. Family and friends who log, or loggers recommended by them, often don't pan out. This can lead to hard feelings as well as damage to the land and financial loss.

A good place to start is to acquire a list of Master Loggers from the Tennessee Forestry Association (615-883-3832), your local Area Forester, or a forestry consultant. These loggers have completed a five-day training session that includes how to use the State's logging guides, or Best Management Practices (BMPs). Not only will following BMPs protect your land, it will help protect you from liability that can result from violation of State Water Quality Laws. Horse or mule loggers might not have had this training, but their method can have less impact on soil than tractors or skidders.

Talk to loggers personally and try to get a feel for their personality and values. Ask for several references, including landowners they have logged for and mills they have sold to. As you narrow down your choices, visit property they are logging or have just finished.

Questions to ask loggers:

- How long have you been in business?
- How long have the crew members worked for you?
- Do you carry workers' compensation and liability insurance? Can I see proof?
- What kind of equipment will you use? How does it match up with my site?
- Do you pre-plan skid trail locations?
- How will you protect "no-cut" trees?
- When and how would you cross a stream?
- What will my land look like after you're done?
- Do you sub-contract sales? How do you ensure quality?
- What BMPs do you normally use? Which would be important on my sale?
- How would you handle timber trespass?

Questions to ask references. Did the logger

- Make timely payments
- Fulfill verbal and written agreements?
- Communicate well, listen to concerns? answer questions, explain things?
- Seem flexible and responsive?
- Delay excessively?
- Avoid damaging trees and improvements?
- Restore, repair and clean up the site before leaving?
- Seem concerned about environmental matters?
- Stop or modify operations appropriately in wet weather?
- Would you have him cut your timber again? Why or why not?

Appendix 9 – When to Sell Hardwood Timber

Landowners too often sell their timber when it is in the midst of rapidly adding valuable wood. On the other hand, some landowners hold their timber past its prime and lose wood to breakage, decay, disease, insects and decline. When is the best time to sell hardwood timber, financially speaking?

The first step is to determine whether your trees have potential to increase much in value. Harvest all trees and start over if the present trees

- Are slow-growing or non-commercial species – beech, hickory, elm, sweetgum, blackgum etc.
- Have defective stems -scar at base, major limb in first 17 foot log, lightning scar, large rotten limb just above the first log, crooked etc.
- Are stunted and slow growing (for the site)

Vigorous trees tend to have long sweeping branches like fishing poles and are clearly growing rapidly upward. Stunted trees tend to have crooked spreading branches and flattened crowns.

If you are satisfied that the majority of your trees are healthy and of commercial species, you are ready to consider the profitability of leaving them to grow vs. harvesting now.

Before explaining the details, the bottom line is that it is most profitable to leave hardwood timber on good sites until it is 18" to 28" in diameter.

Now, the details. There are three sources of value increase: **growth, rising timber prices** and **grade increases.**

Growth. Generally, *vigorous* poletimber and sawtimber on *good sites* has the potential to increase in volume by 6 to 8% per year.

Rising timber prices. Over the past few decades, timber prices have increased at 4 to 6% per year after inflation is taken into account (better grades and species have increased more in price).

Grade. It is obviously foolish to cut fast growing poletimber for pulpwood when it will be worth much more as timber in just a few years. The same principle applies to small sawtimber – it rapidly grows into higher-grade sawlogs and veneer if it is relatively free of defects. Economic analysis shows that trees should be left if they have the potential to jump in grade.

If there is little prospect of grade increase in your trees, here are some factors to consider in deciding when to harvest:

- Leave trees longest on the best sites (deep, moist but well drained loamy soil)
- Good diameter growth will yield high increases in value
- Merchantable height increases will yield only slight increases in value
- Large trees of good vigor produce the highest dollar gains, but produce lower gains figured as a percentage of tree value. (In other words, you have a large "investment" tied up in the wood-producing "machinery" of the tree)
- What rate of return do you want?
    - If you demand a high rate (say more than 6%), cut trees sooner (say, 18 to 20 inches)
- If you are satisfied with a low rate (say 2-4%) you can leave trees longer (say, up to 28 inches)

To calculate what your return will be, use the formula

Present Value = Future Value/$(1+i)^{years}$.

Or **$i = \sqrt[years]{(Future\ Value/Present\ Value)} - 1$**

1. Look up the number of board feet in your tree(s) in a volume table (the bottom 16' log is the most important)
2. Measure the growth rate of your tree(s) with an increment borer (do not bore into the merchantable part of high-quality logs)
3. Figure what the diameter will be in "y" years and look up that volume
4. Calculate dollar values based on, say, the Tennessee Department of Agriculture Forest Products Marketing Bulletin
5. Calculate $\sqrt[years]{(Future\ Value/Present\ Value)} - 1$

Example: Present Value of tree = $100

Value in 5 years (tree growth + price change + inflation) expected to be $145

$i = \sqrt[5]{(145/100)} - 1$

$i = \sqrt[5]{1.45} - 1 = 1.077 - 1 = .077$

i= 7.7% annual interest

Scientific calculators have a $\sqrt[x]{}$ key. An inverse key (INV) can also be used.

Timber price trends can easily be figured in. In this example, if timber prices are increasing at 6% per year, then your timber is yielding 8% + 6% = 14% annually. Any increases in grade will raise this rate further.

Appendix 10 – Controlling Competition in Pine Plantations

Growing pine is like growing a garden or row crop. More crop is produced if weeds are controlled.

Several herbicides control weeds and grasses without damaging pine seedlings. Mixtures can be varied depending on the vegetation to be controlled. These herbicides are sprayed over the tops of newly planted pine seedlings. For maximum effectiveness apply them early in the spring (late March to early April) when the weeds start active growth. Spraying can be done in May or June but much of the effectiveness is lost. A range of concentrations can be used. Higher rates provide longer lasting control at a higher cost.

Herbicide mixes (per acre rates)

- 4 ounces of Arsenal with 2 ounces of Oust. Common mix, provides broad-spectrum control. Cost is about $37 per acre.
- 1 ounce Escort with 2 ounces Oust. Good control of sericea lespedeza. Cost is about $39 per acre.
- 4 ounces Arsenal, 1 ounce Escort, 1 ounce Oust. Controls a wide variety of species including sericea, blackberry and honeysuckle. Cost: $44 per acre.
- 1 quart Velpar, 2 ounces Oust. Controls sericea. Can be sprayed in late February. $33 per acre.

Sericea lespedeza can also be controlled in the fall before planting, allowing use of a wider variety of herbicides (such as Accord, which is Roundup labeled for forestry). However seed will sprout and may require additional spraying.

Spraying can be done over the entire area, in strips, or in spots around each seedling. The strip or spot methods are less expensive. To compare costs among vendors, ask about the rate of chemical applied plus the width of the strip. Strips or spots must be sprayed early. Weeds quickly cover newly planted pine seedlings and grasses and the rows are not easily located. If the rows can't be located, the entire area must be sprayed. Wider strips keep the competition away longer. Sericea reinvades the strips quickly and therefore spraying in strips is risky for control of sericea. Herbicides may be applied by tractor, ATV, helicopter or by hand with a backpack sprayer.

Prior to planting, the area should be bushhogged and burned. This results in a better planting job because the planters can keep up with their rows easier. It also controls weeds better because the herbicide contacts more new vegetation rather than dead vegetation from the previous growing season. If fire is used, some seed is destroyed. (See "Prescribed Fire").

Volunteer hardwoods are present on many old fields. If these are of low value species such as sweetgum or red maple and are numerous, they should be controlled. Hardwoods are best controlled using Arsenal late in the summer or early fall before the leaves turn color. Arsenal does not control legumes or elms well, so a different herbicide should be used if many legumes (locust, redbud) are present. Spray Arsenal directly on the foliage of the hardwoods.

Spraying Arsenal in the spring for weed control will knock back the hardwoods but will not completely control them. Spraying Arsenal in the summer or early fall to control hardwoods also controls weeds, but the weeds are not competing with the seedlings at that time, and the weeds will grow back in the spring. So if both hardwoods and weeds are a problem, two sprays may be needed for best results. But for economy spraying should be targeted to the biggest problem, either weeds or hardwoods.

As with all pesticides, read the label carefully and apply the herbicide as per label recommendations. All necessary precautions should be taken to avoid environmental contamination. Use care near desirable vegetation.

It is recommended that a qualified vendor be hired that can provide the herbicide, labor and expertise to apply it. A list of vendors and/or herbicide suppliers is available from the Division of Forestry.

It is also advisable to subsoil old fields and pastures to allow good root penetration, and to machine plant to make straighter rows. Straight rows are easier to see when applying herbicide.

Pesticides recommended in this publication were registered for the prescribed uses when printed. Should a registration be cancelled, the Division of Forestry would no longer recommend it. Use of trade or brand names in this publication is for clarity and information: it does not imply approval of the product to the exclusion of others that may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product. Landowners are encouraged to contact district representatives of the companies that sell herbicides in their area.

Appendix 11 – Control of Hardwoods in Cutover Areas

Pine can sometimes be planted without controlling hardwood vegetation (on poor sites where the timber was cut very cleanly within the last year or possibly two). However, even in this situation control of competing vegetation is a good investment that will result in higher yields and higher returns. Even if the site looks clean now, vegetation will soon grow up and compete with the pine.

In any of the following cases use of herbicide is absolutely necessary in order to establish a pine plantation:

- highly productive soils found in hollows and bottoms
- areas where many cull trees were left standing following the harvest
- areas where it has been several years since harvest and vegetation has grown back

If the area has grown up and is difficult to walk through, it will be very difficult to plant. Fire is effective at clearing thick, low vegetation (such as grass and weeds) but it is not very effective at clearing briars and trees over head high if there is not ample fuel on the ground to support the fire. In these cases it is necessary to bulldoze to clear the brush.

Several herbicides are available for controlling competing vegetation in pine plantations. The most widely used is Arsenal. Arsenal can be applied either before planting (site preparation) or after planting (release). If used as labeled, Arsenal does not harm pines. Arsenal is sprayed in mid-summer to early fall (from July to when leaves start to turn color – about October 15). Because it is applied late in the growing season, results are not highly evident until the following spring.

Velpar is also effective. It is best sprayed before trees are planted. Spray in late spring to early summer and plant the seedlings the following year. ***Velpar*** can also be sprayed after seedlings are planted, but extreme care must be used or the planted trees may be damaged.

Herbicides can be mixed to provide better control in specific situations. For instance, ***Accord*** (***Roundup*** labeled for forestry) may be added to Arsenal to provide broader control and a quick brown-up to facilitate prescribed burning prior to planting. ***Escort*** can be added to Arsenal to control legumes such as black locust or redbud.

The choice between site preparation and release (spraying before or after planting) depends on many factors. Some of the most important are:

- Heavier rates are used for site preparation, which costs more but results in better control
- The best long term release is obtained two growing seasons after harvest. However, during this time the seedlings are subject to competition
- With release there is no delay in planting seedlings
- With release the seedlings can be observed over several years to see if spraying is necessary
- If pine is to be replanted on areas that were previously in pine and the pine was harvested in July or later, planting should be delayed one season to avoid a pest called Pales weevil.

The cost of spraying depends on several factors but most importantly on the amount of herbicide used. High rates are more expensive, but are more effective and long lasting. In 2001 the average cost is $85 per acre

If ground crews are used, ***Arsenal Concentrate*** is mixed with water to form a ½% solution (one pint in 25 gallons). Add a surfactant or penetrant such as ***Cide-Kick, Ortho X-77*** or ***Timberland 90*** to at least a ¼% solution. The foliage of small trees, brush, shrubs and vines is sprayed with this solution not to the point of runoff with a backpack sprayer. Use 12 to 16 ounces of ***Arsenal*** per acre. The amount used depends on the amount of foliage sprayed. A small amount of ***Arsenal*** on pine seedlings will not harm them, but avoid spraying directly on them. 12 ounces ***Arsenal*** with one ounce ***Escort*** is a good combination.

All vegetation too large for at least 2/3 of the foliage to be sprayed should be injected with arsenal or other appropriate herbicide (see "Hack and Squirt"). This can be done at any time, but is least effective in December to mid January, during spring sap flow, and during drought. If many large trees are present, it may be better to spray with a helicopter. One advantage of ground application, though, is that trees can be selectively spared for wildlife and visual purposes.

Rates for helicopter spraying for site preparation are at least 24 ounces per acre of ***Chopper*** (a formulation of ***Arsenal***) and for release, 12 to 16 ounces ***Arsenal***.

As with all pesticides, read the label carefully and apply according to recommendations. All necessary precautions should be taken to avoid environmental contamination.

It is advisable to hire a qualified vendor that can provide the herbicide, labor and expertise to apply it. A list is available from the Division of Forestry.

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Appendix 12 – Natural Regeneration

There is seldom a need to plant hardwood seedlings. Nature usually provides too many new trees – up to 10,000 per acre! We can guide this process to favor a desirable mix of species with good form and vigor.

Forest regeneration (new trees) comes as seedlings, stump or root sprouts, and as "advance regeneration."

- Seeds of some species can lie dormant on the forest floor for several years. Species that commonly regenerate from seed include yellow poplar, ash, maple, elm, sweetgum and sycamore. Seedlings often take a while to become established and begin rapid growth.
- Sprouts from stumps and roots are the most common means of regeneration in Mid-South forests. Sprouts grow from dormant buds at the base on the tree or on major roots. Oaks especially regenerate this way. Sprouts grow quickly because they draw on food stored in a large root system that formerly supported an entire tree. Advance regeneration includes any viable seedlings or saplings already present in the forest. Oak must be at least 4.5′ tall and 1″ in base diameter before it can compete successfully.

To get good natural regeneration

- Provide **sunlight.** Oak and most other highly--desirable timber and wildlife species must have pretty much full sun to do well.
- Cut low stumps. High stumps can introduce decay into the sprout. Sprouts emerging from roots and from low on the stump chemically seal themselves off from decay.
- Deaden all but the best sprout on each stump, either by cutting or by girdling
- Cut or deaden cull trees

Deaden unwanted sprouts of ***desired*** species by cutting a 2″ wide band through the outer bark and cambium (slick layer).

Deaden sprouts of ***unwanted*** species by spot spraying with Tordon, Velpar or Accord, or by the "hack and squirt" method, where wounds are made around each sprout and squirted or painted with herbicide.

Oak may appear to be scarce in the dense sapling stage, but within 10-20 years many competitors will drop out, leaving a more prominent oak component. Poplar may be very plentiful at first but tends to succumb to droughts on drier sites.

Growing oak on good sites is problematic. Intensive clearing of competitors is one option. Securing advance regeneration is another. This can done by a modified shelterwood, where the midstory trees and 10% of the canopy is removed. This should provide enough sunlight for oak advance regeneration to develop. When it reaches 5-10 feet tall, the remainder of the stand is harvested. This technique is based on the fact that oak seedlings are fairly tolerant of shade until they reach sapling size.

Appendix 13 – Hack and Squirt Control of Unwanted Trees

Hack-and-squirt herbicide injection is a cheap and easy way to kill undesirable trees. It can be used alone or in combination with other vegetative control methods for

- Natural regeneration
- Crop tree release
- Timber stand improvement
- Stand conversion
- Cull tree removal
- Creating cavity trees for wildlife

Hack and squirt should not be attempted during spring sap flow. The best time for treatment is July to October. The method works well on thin-barked species, especially red maple, and not well on yellow poplar and tough-barked species like hickory.

Equipment needed:

- Small sharp ax or hatchet
- File for sharpening
- Quart capacity trigger-activated squirt bottle (1 ml/squirt) with chemical resistant seals
- Safety glasses
- Rubber gloves
- Chainsaw chaps

Commercial squirt bottles are available at auto supply stores, chemical supply catalogues and forestry equipment suppliers.

Wear personal protective equipment as specified on herbicide label.

Cut into the tree at a height that is comfortable for you. Strike the tree at a downward angle. Be sure the cut penetrates into the sapwood. Each cut must form a pocket that will hold the herbicide. Spilled herbicide is wasted unless it stays in the cut. Space the cuts evenly around the stem according to the label directions (see below). Squirt one "shot" into each cut.

When treating stump sprouts, inject each stem in the clump. Try to make cuts below the crotch of low forks. Some species such as sugar maple, hickory and chestnut oak have thick bark that is hard to penetrate and may require more cuts.

When preparing a site for natural regeneration, inject only trees of non-desirable species. Cut down non-merchantable trees of desirable species so that they will regenerate from stump sprouts.

Hack-and-squirt can be done in any season. However, spring sap flow can push out the herbicide. Frozen trees should not be treated. When hard freezes occur at night, antifreeze may be added according to label directions.

Herbicides for hack & squirt to control hardwoods (always follow directions on the label.)

Garlon 3-A/Arsenal mix works well on a broad range of hardwoods. Mix one part *Garlon 3-A* with three parts water, plus six ounces of *Arsenal AC* per gallon of mix. Make cuts around tree with ends of cuts one inch apart.

Tordon RTU: No mixing required – use full strength. Comes with a dye to help monitor application. Space cuts with two or three inches between cut ends. Can be used on stump cuts to prevent resprouting. Red maple is somewhat resistant.

Pathway: Another type of *Tordon.* Use full strength. Comes with a dye. Space cuts same as *Tordon*. Can be used to treat surfaces of cut stumps.

Arsenal AC: One part *Arsenal* to nine parts water. Hack once for every three inches of tree diameter (a 12 inch diameter tree will require four hacks.) Slow acting – may take two years to kill. Less effective on black locust, honeylocust, blackgum and redbud.

To control pine and red-cedar, use full strength *Garlon* with the ends of cuts two inches apart.

Sources for forestry herbicides and equipment

Local Farmers Cooperatives

Forestry Suppliers, Inc.
205 West Rankin St
Jackson MS 39201 1-800-647-5368

Ben Meadows Company
3589 Broad Street
Atlanta GA 30341 1-800-241-6401

UAP Timberland LLC
PO Box 557
Monticello AR 71655 1-870-367-8561
www.timberlandenterprizes.org for sales

Chemical Containers, Inc.
PO Box 1307
Lake Wales FL 33859 1-800-346-7867

Appendix 14– Control of Grapevines

Grapevines can damage trees by breaking tops and limbs, pulling the tree treetops down, by increasing ice storm damage, and by shading the leaves in the tree crowns. Damage is more likely on good to excellent sites than on poorer sites.

Grapevines can be controlled by severing or by basal bark application of an oil-based herbicide. Severing is effective if performed at least four years prior to harvest. That amount of time is necessary to allow shading to kill new grapevine sprouts. Grapevines are intolerant of shade, so although cut vines may sprout prolifically and send up long vines, they will die if the trees above are tall enough, that is, 18 feet in unthinned stands and 25 feet in thinned stands. Cutting vines in shorter trees will result in partial control.

Vines should be cut at least four years before harvest, or basal sprayed, to prevent re-infestation of regeneration. This is especially important if clear-cutting is used because clear-cutting provides the full sunlight grapevines need. When practicing selection harvest or crop tree selection thinning, cut all grapevines if possible. This is because vines can spread from neighboring trees and infest the crop trees.

In some cases a young stand will be so heavily infested that it is entirely covered by vines. In this case chemical control is necessary. Unfortunately, there is no way to kill the vines without also killing the young trees. Studies have shown that good control can be obtained with basal spraying with an appropriately labeled oil-based herbicide, by using a mistblower to apply an appropriately labeled water-based herbicide, or by broadcasting Tordon 10K pellets. Even after chemical treatment, dormant grape seeds will continue to sprout for at least 15 years, making control necessary again when saplings are tall enough.

Grapevines are very beneficial to wildlife. If wildlife habitat is a management objective, a goal of only partial control may be appropriate.

Appendix 15 – Control of Weeds in Wildlife Food Plots

Weed competition in wildlife food plots may threaten your plantings. Some infestations may be light enough to tolerate, or to control satisfactorily by mowing, by planting tall grains that will compete with the weeds, or both. Mowing is an option with clovers, which respond well to cutting. Corn or sorghum planted after two plowings (in early- and mid-spring) might outgrow the competition.

Herbicides will usually be your best bet to control a serious infestation. The first step is to identify the weeds, then select the herbicides. There are dozens of brands on the market, but we will use as an example three that have wide use and brand-name recognition. 2,4-D, an ingredient of many herbicides, controls broadleaf weeds without affecting grasses like millet, corn or wheat. (Note: do not use 2,4-D around walnuts.) Grasses can be controlled by Poast and similar formulations without harming broadleafs. Roundup (glyphosate) kills both broadleafs and grasses.

It is very desirable to plan ahead so that timing will be right. Observe what grew on the plot last year. If grass was the main problem, plant a broadleaf forage crop and treat with a grass-specific herbicide like Poast. If broadleafs are the main problem, plant grasses and spray with a herbicide containing 2,4-D. If both are serious problems, spray with Roundup or similar broad-spectrum herbicide prior to planting. Time application of herbicides to kill weeds before they seed.

The ideal way to plant after spraying with Roundup is with a no-till seed drill, since plowing or harrowing will turn up more weed seeds. But if you don't have the right equipment, spray, plow, wait two weeks, plow again, and plant.

A backpack sprayer is practical only for small openings and roadsides. For larger openings, a sprayer equipped with a boom and fan nozzles is called for. Such a sprayer can be mounted on a pickup, tractor or ATV and will cost between $150 and $2,000. Herbicide application costs will run $15 to $50 per acre.

Appendix 16 – Liming Wildlife Food Plots

Liming is often as important as fertilizing. Lime "liberates" nutrients stored in the soil. As lime makes soils less acidic, it also enhances the growth of soil microorganisms. This is especially important for the bacteria used to inoculate legumes. Legumes do best in non-acid soils, ideally at pH levels (a measure of acidity) of 6.0 to 7.0. By comparison, many forest soils in Tennessee have pH values of 5.5, which is moderately acidic.

Lime comes in a range of forms, from powder to grit to pellets. The finer the grind, the more immediate the effect the lime will have on soil acidity, but the more rapidly the effect will dissipate.

Till in the lime before planting the crop, ideally several months in advance so that the soil pH has time to adjust. If more than 2 tons per acre are called for, it is best to spread the lime in 2 applications 6 months apart. In planning the time to lime, schedule a time when farmers are not liming their fields. Commercial applicators are more likely to take small jobs during the off-season.

Take soil samples to your Extension office to determine how much lime to apply. In Tennessee two tons per acre is usually needed, but some forest sites may require up to three or four tons per acre. For accessible sites, powdered lime plus commercial application cost will run $20+ per ton per acre. Manual application of bags of pelletized lime on plots inaccessible to spreader trucks will run about $80-100 per ton per acre for the lime alone.

Appendix 17 – Building Brush Piles for Wildlife

Nearly all animals need cover, so they can escape from predators, rest in safety, nest and raise their young, and find shelter from extreme weather. Brush piles will benefit two game animals, rabbit and quail, but will also provide a home for other ground nesting birds, amphibians and reptiles. Brush piles bring the fastest response of any forest wildlife management tool.

Locate brush piles near food and near the edges of forest openings. Do not pile brush closer than 10 feet from trees with potential commercial value, since bark beetles and borers feeding on the dead brush can attack nearby trees.

To maximize the benefits of brush piles, place larger materials on the bottom and leave tunnels for access. Three types of bases work particularly well: large pole-size logs, piles of rocks, and stumps.

Lay four poles measuring six inches in diameter and six feet long parallel and a foot apart. Then lay four more on top perpendicular to the base logs. If rocks are used, make three stacks about two feet high, about six feet apart, forming a triangle. Place large limbs to form the sides of the triangle and pile other limbs across them. Or, select a tall stump and lay large limbs on it. Pile more limbs on these foundations to a height of six to eight feet.

A long-lasting alternative is to make a "living" brush pile by cutting partway through saplings so that they fall in a crisscross pattern over each other. Pile branches over these, but leave enough of the tops exposed so that the trees remain alive. Or, bend down or break low-growing limbs of a smallish tree and pile brush over them.

(Excerpted from Wildlife Management for Tennessee Landowners, Tennessee Wildlife Resources Agency)

Appendix 18 - Attracting Deer

Tennessee has an abundance of deer. But since deer have a range of 300 to 2,400 acres, they will usually be subject to hunting on adjacent lands. You can nevertheless attract deer to your property by providing what they seek: nutritious food, minerals, and shelter. Groves of evergreens (cedars or pines) as small as five acres supply usable shelter. Minerals can be placed in a depression and worked into the ground. The mix should contain 25% to 50% salt and have a calcium to phosphorous ratio of 2:1. It is illegal to mix food with salt and then hunt over it.

Food during critical seasons is usually the factor that limits deer populations and so it is what they seek most. There are three ways to provide food: cut trees, plant food plots, and fertilize.

Forest openings an acre or more in size have up to 10 times as much wildlife food as the forest interior. Making openings as small as 1/8 acre (about six mature trees) can provide forage and possibly some income from timber. However, to be optimal, openings should be an acre in size. Ideally, openings should comprise 1-5% of the total forest area. These areas will reforest naturally, and so new openings will need to be made every few years. Dense sapling stands that grow up in these openings will provide prime fawn rearing habitat.

Plants in forest openings highly preferred by deer include Japanese honeysuckle, blackberry, greenbriar, strawberry bush, persimmon, ash, and oaks. The protein content and yield of these plants can be raised by fertilization, which should help attract deer. Using a timed-release fertilizer high in nitrogen, such as 36-3-7, will save time, effort and cost, and will minimize loss of nitrogen through leaching and volatilization. As a rough guideline, apply about 500 pounds per acre in the early spring. Or, apply about 250 pounds per acre of a conventional high nitrogen fertilizer (such as 24-6-6) in March, May and September. Fertilize mast-bearing trees in the same way. Timed-released tablets are available; insert them at the edge of the tree's root zone at a rate of four for every one inch of diameter. These will release nitrogen for up to two years.

Liming should not be neglected when fertilizing native vegetation. This will sometimes be difficult due to inaccessibility, but areas treated need not be large. Manually liming 1/8-acre plots will cost around $50 each if contracted out; a few plots of this size can be readily limed by most landowners. (See "Liming Wildlife Food Plots").

Late summer and late winter are times when food is least available and of lowest quality. Supplemental summer crops (and planting dates) include

- Soybeans (April-June)
- Cowpeas (April-June)
- American jointvetch (March-June)
- Rape (April-July)
- Lablab (April-June)
- Corn (March-May)
- Millet (April-July)
- Grain sorghum (May-July)

When mixing planted foods, be sure one will not crowd another out. For instance, cowpeas can be planted with corn, but only small grains should be planted with clovers. Winter food plots should contain a mix of

grains and clovers. Use a low-nitrogen fertilizer such as 7-27-27 when fertilizing legume/grain mixes. Consult with your county Extension agent for recommendations on varieties and seeding rates.

Prescribed fire will increase spring forage amount and quality. You will need a permit from the Division of Forestry. Inexperienced persons should not attempt a prescribed fire. The Division of Forestry can advise you, and can sometimes assist. (See TDF technical bulletin "Prescribed Burning" available from your area forester or on the web at www.Tennessee/agriculture/forestry).

Mowing and disking are low-cost options. Disking in December will promote growth of partridge pea and ragweed, which are utilized by quail and heavily browsed by deer. April disking will favor grasses. June disking benefits deer, and it promotes insects needed by turkey and quail.

Appendix 19 – Managing the Forest for Gray Squirrel

Gray squirrels need hardwoods, especially nut producers (hickory, beech, white oak group, and red/black oak group, in that order, and walnut where it occurs.) Berries, soft fruits, buds, seeds, and fungi are supporting foods. Red maple is particularly important in early spring and mulberry in May and June. Foods by season include:

August-October:
Nuts and acorns
Sugar maple, pine and yellow poplar and seeds
Hornbeam seeds
Dogwood, blackgum, hawthorn and cherry fruits
Fungi
Insects

November-January:
Nuts (including acorns)
Blackgum fruit
Yellow poplar seed

February-April:
Red and black oak acorns
Fungi
Buds & flowers
Red maple seeds

May-July:
Buds, flowers
Berries
Fungi
Insects
Yellow poplar seeds

Nuts (hard "mast") are the mainstay of squirrels' diet in the critical fall, winter and early spring months. Half of the forest should be oak, beech and hickory. Acorn production usually starts about age 20-25 and peaks between age 40 and 80. Generally, red oaks produce the highest yields, followed by white and chestnut oaks, then black oak. Acorn crops are not consistent from year to year; good crops usually occur only every 2-5 years. White oak bear seed annually, red oaks every other year. White oak acorns are more edible, while red oak acorns are more durable. A mix of oak species is best. Sawtooth (or Chinese) oak seedlings can be planted to provide heavy yields every year, beginning at an early age.

Shelter is important. Squirrel pup survival is much better in waterproof dens than in leaf nests. Good den trees must usually be at least 40 years old. Maple, beech and black cherry are especially good. Retain at least 1 or 2 potential den trees per acre (3 is ideal) during all stages of forest growth. Select only trees that should be able to live for at least 25 more years.

How to harvest timber to favor squirrels:

1. Thin existing stands to increase mast production and stimulate growth of foods beneath the canopy. Squirrels prefer a well-developed forest mid-story.
2. Protect grapevines (if not damaging crop trees.)
3. Use timber harvest methods that allow good oak regeneration, leave evenly distributed mast-bearing trees and den trees, promote good hard mast crops and supporting foods. Alternatives:

- harvest small blocks of trees (1/4 to 1 acre)
- create a two-age forest (harvest roughly 1/2 of the trees when the stand is between age 40 and 80 and plan on harvesting the rest in 20 to 40 years). This ensures continuous mast production and good midstory growth.
- use a "wildlife shelterwood", i.e., leave several large mast-bearing trees per acre
- avoid diameter limit cutting. If diameter limit harvesting is used, leave hard mast-bearing trees and are potential den trees.

4. Leave den trees, especially if clearcutting.
5. Regenerate oak (this can be difficult on good sites – see a forester to improve success.)
6. Schedule timber harvests to ensure a steady supply of oaks of prime mast producing age.

Appendix 20 – Managing the Forest for Songbirds and Raptors

Open fields, brush, swamps, moist woods, dry woods, open woods, tall timber, dense tangled undergrowth, back yards, woodland margins – each is favored habitat for a number of bird species. You can attract many species by creating diverse habitat. Or you can tailor your forest for specific species.

The greatest numbers of species and individuals can generally be found near water and at forest edges. "Edge" is the transition from open land to forest. Edges should undulate and should be "feathered" (not abrupt or "hard".) Feathered edges, ideally 150' wide, taper in height and density, from 25% tree removal near the woods to 75% near the opening. A feathered edge allows a rich understory to grow, diversifies the habitat, and helps protect against predators and cowbirds than does an abrupt edge.

Brown-headed cowbirds are the greatest threat to songbirds in the U.S. Cowbirds live in agricultural areas and fly into the forest as far as a few miles to lay eggs in other birds' nests. Some songbird species kill cowbird chicks, but others raise them. For these songbirds, areas not easily accessible to cowbirds – including newly harvested forest - are prime habitat.

While some bird species thrive in a diverse setting, others need large uniform habitats. Groups or "suites" of species share a given habitat. The suite currently of most concern uses large blocks (5,000 acres or more is optimal) of tall trees. Species include cerulean warbler, wood thrush, worm-eating warbler, wood peewee, Kentucky warbler and the acadian fly catcher. Retaining large tracts of tall timber, or land adjacent to large tracts, will benefit this suite. Some timber harvesting (on a long "rotation" basis) can be compatible with this suite, and may even benefit it.

Clearcuts and young second-growth forests are also currently lacking for suites including prairie warbler and woodcock. Bottomland forests are another critically important bird habitat.

Any forest management, including no action, will benefit certain species and detract from others.

The best thing most landowners can do to conserve songbirds and raptors is to **leave all or most of the trees within 100 feet of perennial streams.**

Cover protects birds from predators and weather. Pines (especially white pine), cedars, brambles and tree cavities provide good cover, perches for resting, roosting and singing, and insects. When harvesting timber, especially when clear-felling large areas,

- Leave the largest diameter trees having active cavities, and 3-5 trees around them.
- Leave these clumps on lower slopes, upper slopes, and near edges of clearcuts. Clumps in the middle of large clearcuts should be connected to the surrounding forest by strips of trees (travel lanes.)
- Try to leave at least one or two clumps per acre
- If there are plenty of cavity trees to choose from, retain those that are long-lived (white oak, beech, sugar maple, yellow poplar), large in diameter and bear mast (food.)
- Leave 2 or more snags per acre. These should be at least 12" diameter and 10' tall. Unlike live cavity trees, snags don't inhibit seedling growth. *Snags can be created* by girdling live trees of low commercial value.

Raptors benefit from perches in or near weedy or cut-over areas where small mammals, birds and snakes are abundant.

In addition, ***don't harvest timber during nesting season*** *(April to July for almost all songbirds, and as early as February for hawks and owls) and* ***avoid using insecticides*** *(especially broad-spectrum insecticides) in the spring, since many songbirds eat insects.*

References:

- Various field guides
- Land Manager's Guide to the Birds of the South by Paul Hammel, US Forest Service General Technical Report SE-22, published by the Nature Conservancy
- Breeding Bird Atlas (UT Press)

Appendix 21 – Managing the Forest for Wild Turkey

Turkey's habitat and food needs change seasonally. Turkey consume a wide variety of nuts, seeds, weeds, fruits and insects. Habitat should include:

- oak forest (acorns are a staple food for turkey). One third should be of acorn bearing age (25 years, peaking from 40 to 80 years)
- pine stands (roosting, pine nuts and insects). Maintain in an open condition
- grassy or weedy openings (nesting, brooding, bugging), and agricultural fields (10% of the total habitat in openings is sufficient). Native warm-season prairie grasses are especially desirable – they can easily attract one nest per acre.

.Prescribed fire is very helpful in managing turkey habitat.

- Prescribed fire in older pine stands provides the open forest floor turkey like.
- Light controlled fire in oak forests also benefits turkey but can damage oaks.
- Native warm season prairie grasses require the use of prescribe fire.

See TDF technical bulletins "Prescribed Fire" and "Native Warm Season Grasses" available from your area forester or on the web at www.Tennessee/agriculture/forestry.

Turkeys often nest in clearcuts and fallow fields in which some blackberry and other brush has grown up. Some biologists think that 20-30 acre clearcuts provide better protection of nests than fields or small openings.

Periodic timber harvests provide temporary nesting/bugging habitat and can also assure a future supply of acorns if oaks are regenerated. Ideally, harvest and regenerate 1% to 1.5% of the forested area per year.

Maintain permanent plots for food, nesting, bugging and brooding by disking, fertilizing with 400-500 lb/ac 6-12-12 (or 200-250 lbs/ac 12-24-24), planting seed-bearing vegetation, and burning 1/3 to 1/5 of the open areas each year on a rotational basis. Disk 15 to 30 foot wide strips, alternating disked and undisked strips every 3 years. Planted foods might include chufas, browntop millet, corn, wheat, crimson and other clovers, grain sorghum, buckwheat, lespedeza and sunflower. Roadsides and power utility line rights-of-way also serve as permanent plots if managed in this way (except for burning where it is inappropriate); mowing in February and August is another option for turkey, quail and deer. Do not mow or disk during nesting season (April - July).

Forested areas should interconnect to provide travel corridors. Leave 50-foot wide strips of hardwoods along all streams.

Appendix 22 – Quail Management

Bobwhite quail are not usually abundant in most forest-dominated landscapes in Tennessee, but are often present nonetheless and can benefit from proper management of forests and openings. Quail utilize open pine and hardwood forests interspersed with grass, weeds, scrubby growth and small fields. They feed on seeds, insects, and succulent browse and like to nest in clump grasses or brush close to the edge of clearings. Activities that create nesting and brood habitat are the practices most beneficial to quail in forested areas.

To provide habitat favorable to quail, harvest timber in small blocks or narrow strips, use prescribed fire, maintain plots in a weedy condition, plant favored foods, and provide plenty of cover. Thinning and prescribed burning of pine stands will greatly improve conditions for quail as well as increase the growth of the remaining pines. Managing either hardwoods or pines to sawtimber stage at wider spacings that allow the sunlight to stimulate more abundant growth of native grasses and forbs will provide the most optimal management for quail in woodland settings over larger areas.

Food plots should be at least 1/8 to ¼ acre in size. Locate one for at most every 10 to 20 acres of forest. Old log landings are ideal.

Quail utilize both native seeds and planted foods with roughly equal preference; the benefit in planting forage is that these crops will provide a large amount of food in winter as forage from native species becomes scarce. Native "weed" plots mowed or disked after nesting season (that is, April to August) will provide both seeds and large amounts of insects that quail feed on.

Favorite planted foods include browntop or German millet, shrub lespedeza, bicolor and Korean or Kobe lespedeza, grain sorghum, cowpeas, soybeans, partridge peas and buckwheat. These can be planted on entire food plots or they can be rotated with fallowed weedy strips. Disk these plots in strips 15 to 30 feet wide, alternating disked and undisked strips every 3 years.

Lime and fertilize grain plots with 200-250 lb/ac 12-24-24, or 0-20-20 on lespedeza or partridge pea plots (see "Liming Wildlife Food Plots). Do not mow, disk or burn during nesting season (April – August).

Provide cover and food along fencerows and wood margins by planting and/or encouraging growth of fruit and seed bearing plants such as blackberry, grape, sumac, poison ivy, dogwood, blackgum, cherry, redcedar, and oak – especially oaks with small acorns, such as pin oak. (see "Fencerows and Headquarters Areas"). Cover can be immediately enhanced in open areas by creating brush piles. Make each about the size of a car.

Some bare ground near cover is desirable and will be utilized by hens and chicks immediately after hatching.

Plant and maintain openings and roadsides in native warm season grasses (see TDF technical bulletin "Native Warm Season Grasses" available from your area forester or on the web at www.Tennessee/agriculture/forestry). These provide excellent cover, mobility, and food, and bare ground between clumps that enhances quail chicks' movement and foraging. Tall fescue and other grasses that form a thick sod inhibit movement and do not provide good habitat for quail.

Burn plots either every 2 years or burn half one year and half the next. The freshly burned area provides brood rearing habitat, while last year's burn provides nesting habitat. It is also beneficial to burn fields and under pine stands every 3-5 years on a rotational basis. Fire clears away dead grass and encroaching brush, rejuvenates desirable food and cover, favors native warm season grasses, and creates the open conditions preferred by quail. Protect brush piles from fire. A permit is required from the Division of Forestry to burn outdoors between October 15 and May 15. It is highly advisable to get experienced advice and have plenty of help (see "Prescribed Fire").

Help with quail habitat can be obtained from the Tennessee Wildlife Resources Agency www.tnwildlife.org and from Quail Unlimited www.qu.org.

Appendix 23 – Leasing to hunters

Hunting leases average $2 per acre for tracts over 150 acres and $4 per acre for less than 150 acres. Prime waterfowl areas can bring $7 to $8 per acre or more. However, markets are highly localized, and the price a lease will bring depends on many factors, including

- location
- amount of land
- amount, quality and species of game
- services provided (15% of leases include accommodations other than camping)
- nature of the agreement (time period covered, land management, special provisions such as reserving the family's right to hunt.)

Often, land is leased for enough money to pay the taxes.

Small, odd, isolated fields may very likely produce a greater financial return from hunting than from agriculture.

Landowners with small acreage can join with neighbors to offer a larger block of land.

The primary species hunted under leases are deer, rabbit, turkey, raccoon, quail, duck, geese and grouse. Habitat can be improved to increase populations and hunting success.

It is desirable to have some idea of the numbers of the game animals present. This can be done in a general way by referring potential leasees to the Tennessee Wildlife Resources Agency (TWRA) county wildlife technical reports, and to the local wildlife officer who will know which areas of the county carry the most game. Some forestry/wildlife management consultants will perform population surveys for individual ownerships. However, these are very time consuming and are subject to many variables.

Hunters who lease land know they have a place to go. They feel greater ease and safety, and they feel they have a higher chance of success. The quality of the hunting experience is as important to many hunters as hunting success. Surroundings, exclusive use of the land, availability of game, and services provided all contribute to a quality hunting experience.

7.5% of hunters currently lease private land, a similar number (18,000) who are not leasing are "very interested," and another 14% are "somewhat interested." Most share a lease with up to 6 or 7 people. As more "no trespassing" signs go up on private land, leasing is becoming a more attractive option for hunters.

Leasing has two drawbacks. The most serious is liability. "Hold harmless" agreements are generally ineffective. Landowners should take out liability insurance if they want to protect against the unlikely event of a lawsuit from a hunter. Ten percent of leasing landowners carry liability insurance. A second and easily resolved question is family hunting rights. If the leasing family intends to continue hunting on the land, this should be specified in the agreement.

Advertising can be done by word of mouth, in newspapers, on bulletin boards, and through the Tennessee Private Lands Hunting Register. See your county Extension office to sign up.

Appendix 24 - Capital Gains, Timber Basis, Capital Accounts and Depletion

Timber is considered a capital asset for taxpayers who qualify as "investors" or as "in the timber business" (which can include landowners who manage timber for profit). See Forestry information sheet *"Filing Status for Timber Sales".*

The tax rate for long-term capital gains is 5% for the 10% and 15% brackets. Above the 15% bracket the rate is 15% - still low compared to the rates for ordinary income. No self-employment tax (15.3%) is paid on capital gains.

Besides providing a lower tax rate, capital gains treatment allows you to deduct the cost basis of the timber you are acquiring. Having a basis also allows you to claim a loss if the timber is destroyed by an unusual, unexpected and sudden cause (called a *casualty loss*), including fire, theft and storm.

Your *initial cost basis* is the fair market value of the timber on the first day of the year in which it was acquired, plus acquisition costs (cruise, survey, legal fees, etc). It does not include the cost of the land. A forester can assist you in establishing a cost basis retroactively from tree growth rates and old marketing reports. You do not have to establish a basis in order to get capital gains treatment.

To calculate a timber basis, first figure what percentage of FMV was contributed by timber, and then multiply that percentage by the purchase price. For example: say you buy land with a total FMV of $150,000 including $60,000 for 340 thousand board feet of timber; you paid $170,000 total (including expenses) [Note: FMV, i.e., "appraised" value and sale price are seldom equal.]

1. $60,000/150,000 = .4; that is, the timber makes up 40% of the FMV.
2. 40% of $170,000 = $68,000 = the basis for the timber. Your depletion unit is $68,000/340,000 BF = $200 per thousand board feet.

Each year, add any new capitalized costs (the cost of constructing permanent roads, reforestation costs not amortized under the special IRS 7-year amortization option) to your timber basis. Also add items you are depreciating. Each year, as you deduct depreciated costs from your income, also deduct the same costs from your timber account. The current total of costs in your timber account is called the *adjusted basis*.

The process of deducting your basis as you sell your timber is called *depletion;* the amount you can subtract per unit harvested is your *depletion unit*.

For example, you buy 10 acres of timberland for $15,000. For simplicity let's assume that this is also its appraised fair market value (FMV). The timber was appraised at $4,000, and the volume is 20,000 board feet. Your initial cost basis is the FMV of the timber ($4,000), and the depletion unit is $4,000/20,000 = $200 per thousand board feet.

Often land sells for other than appraised fair market value. In that case you must allocate the purchase price between assets (land, timber, etc.) in proportion to the FMV of each.

When you get ready to sell timber, you can determine how much to deduct from your capital gains simply by multiplying the depletion unit times the volume sold.

For example, if you sell 5,000 board feet, and if your depletion unit is $200 per thousand board feet, you can deduct 5,000 x $200/1,000 = $1,000.

It is important that you keep your timber account and volume up to date so that you have an accurate depletion unit when you sell. A pre-sale timber cruise will provide current volumes.

Separate accounts should be set up for

- land; this includes permanent road costs
- depreciable land improvements, including temporary roads, bridges, culverts, gravel, firebreaks and fences
- classes of equipment
- reforested areas and young timber. Any undepreciated expenses in these accounts are carried over to the timber account when the accounts are combined. Sub-accounts can also be set up for different stands of timber.

Report adjustments to basis and volume, and allowable basis deducted at time of sale, on Form T Schedule F; report timber sale profit on Form T Schedule C.

Appendix 25 – Tax Deductions and Depreciation

Landowners who can demonstrate a profit motive can deduct 1) capital costs (which form the cost basis of the property); 2) currently deductible expenditures for management and protection; 3) costs of sale.

Capitalized costs include items that are being depreciated, and costs that must remain in the capital account and be deducted from proceeds when the timber is sold. The latter include acquisition costs (cruise, survey, legal fees, etc.), construction of permanent roads, and reforestation costs not amortized under the special IRS 7-year amortization provision. Sale costs are also subtracted from timber sale revenue.

Currently deductible expenses can be deducted in the year they occur. To be deductible, expenses must be "ordinary and necessary costs" related to making a profit. These include carrying charges (property taxes and interest) and operating costs not related to a capital project: consultant and professional fees, hired labor, non-commercial silvicultural expenses, protection costs, travel expenses necessary for managing the land for a profit, tools with a life of less than a year and costing less than $100, routine equipment maintenance, etc.

Filing status determines how currently deductible expenditures are treated:

- An investor can deduct expenses which, when aggregated with all other "miscellaneous itemized deductions" exceed a 2%-of-adjusted gross income floor from income from any source. Exceptions are property taxes, which are fully deductible against income from any source, and interest, which is deductible against net investment income (2% floor does not apply). Alternatively, investors can capitalize expenses (see below). In this way expenses can be recovered when the timber is sold.
- A "passive" business manager can deduct all currently deductible expenses, but only against passive income; unused deductions can be carried forward indefinitely and applied to future passive income
- An "active" business manager can deduct all currently deductible expenses from income from any source.

See Forestry information sheet, *"Filing Status for Timber Sales"* for criteria.

Landowners can elect to capitalize carrying charges and operating costs. Carrying charges can be elected annually, but election to capitalize operating costs (such as timber stand improvement) must remain in effect until the management is completed. Carrying charges cannot be capitalized if the land is developed (built on), nor can they be capitalized in any year the land produces income.

Investors report deductions (above 2% floor) on Form 1040 Schedule A; businesses report deductions on Schedule C, and farmers on Schedule F. Notify the IRS of the election to capitalize carrying charges and operating expenses on a plain piece of paper.

Depreciation is accomplished by annually deducting the allowable amount for that year from both gross income and the capital account. Depreciable property includes office equipment, vehicles, tractors and similar equipment, tools with a life greater than a year and costing more than $100, fences, bridges, culverts, buildings, temporary roads, and the surfaces of permanent roads.

Property is depreciated according to a schedule set by the IRS for that item. Tables are found in IRS Publication 946, How to Depreciate Property. The most commonly used set of IRS depreciation tables is the Modified Accelerated Cost Recovery System, or MACRS. To select a table, you must know the placed-in-service date, the convention used for that item, and the depreciation method.

The most common methods are the 200% declining balance over the General Depreciation System recovery period (for non-farm) and the 150% declining balance over the GDS period method (for farms). See IRS tables in Publication 946.

"Convention" can be mid-year, mid-quarter or mid-month, but usually mid-year. Under the half-year convention, only half a year's deduction is taken in the first and last years; this stretches the basis recovery period over an added tax year. *(Note: If more than 40% of an item that would normally be depreciated using the half-year convention is placed in service during the fourth quarter, it must be depreciated using the half-quarter convention.)*

Recovery periods:

- Basis recovered over **five** years: computers, light trucks, portable sawmills, copiers, logging machinery and road building equipment used by loggers and sawmillers for their own account
- Basis recovered over **seven** years: office furniture and equipment, farm fences
- Basis recovered over **15** years: bridges, culverts, non-farm fences, temporary roads, permanent road surfaces

Under Section 179, up to $25,000 of expenditures (after 2002) can be deducted in the year the money was spent. For example, if you purchase a truck for $20,000 you can deduct it entirely in the year purchased without having to amortize it over a five–year period. An item must be used more than 50% in the business to qualify for Section 179 treatment. Elect Section 179 treatment on Form 4562.

Listed items are things commonly used both at home and in the business. Listed items include cars, computers, cell phones, etc. Deductions must be in proportion to business versus personal use. For example, if a truck is used 60% for the business, the annual deduction listed in the IRS tables must be multiplied by 0.6. If an item is used in the business less than half the time, it can no longer be depreciated by the 200% or 150% methods, and instead must be depreciated using the straight-line method (see IRS tables). It is important to keep detailed records of use of listed items.

Maintenance is a deductible expense, but repairs that increase the value or lengthen the life of equipment must be capitalized.

A "units of production" method may be elected for temporary roads. Amortized costs are allocated proportionate to the units removed in a given year divided by the total number of units removed.

You cannot capitalize both road construction and the equipment used in construction. Equipment amortization for the period it is used must be entered into the capital account for the road.

Assets depreciated using the same method and convention can be grouped together for accounting purposes. Write "general asset allocation made under Section 168(i)4" on the top of Form 4562.

If you sell depreciated property, the amount received for the depreciated item, up to the depreciated amount, is recaptured as ordinary income; money you receive above the depreciated amount is taxed as a capital gain.

Use Form 4562 section II to classify property and take the first deduction for property placed in service the previous year; use section III for deductions for property placed in service during prior years; use section V to document business use and calculate deductions for listed property.

See IRS publications 946 “How to Depreciate Property”, 225 “Farmers Tax Guide”, and 334 “Tax Guide for Small Business”.

Appendix 26 – Filing Status for Timber Sales

How you report a timber sale and whether you get capital gains treatment depends on whether you qualify as a hobbyist, investor, passive manager or active manager.

Hobbyists do not own their land primarily to produce a profit from timber. They must report any timber sales as ordinary income and can deduct sale expenses from sale proceeds in the year of sale.

To qualify as an investor or business, the landowner must demonstrate a profit motive for holding land. This can be done by having a current forest management plan, projecting future profits, participating in activities related to timber growth and sales, etc.

Investors have a profit motive for owning timber, but they sell timber infrequently, do not participate actively in timber management, and do not own their timber as part of a trade or business. Many absentee landowners fall into this category.

Investors can get capital gains treatment. Investors can deduct expenses against any source of income, above a 2% floor. All deductions below this 2% threshold are lost. Alternatively, investors can capitalize all expenses and recover them when the timber is sold Investors can deduct property taxes from income from any source, and can deduct interest from investment income. Investors, like businesses, can deduct casualty losses from any source of income. Investors don't pay self-employment tax on cost share payments, while businesses do.

Persons are considered "in the timber business" if they are more active in their management than investors, if they sell timber fairly regularly, or if they own the timber as part of a trade or business. Growing and harvesting timber, as in a Tree Farm, can qualify as being in the timber business.

"Passive" managers are more involved in managing than are investors, but less involved than active managers. Passive managers can deduct all expenses, but only against passive income. However, they can carry forward unused deductions indefinitely and apply them against future timber sale income.

"Active" manager status is generally the most advantageous, since active managers can deduct expenses against income from any source.

The IRS "passive loss rules" are the standard by used to determine whether you qualify as an active or passive manager. To qualify, your participation must be "regular, continuous and substantial" as defined by the following tests:

1. you spent more than 500 hours per year managing the business, or
2. you conducted substantially all the management activities related to the business, or
3. you participated for more than 100 hours and no one participated more, or
4. your participation in "significant activities" exceeded 500 hours (a significant activity is one where your participation exceeds 100 hours but doesn't in itself meet a material participation test).
5. you materially participated (were consider an "active" manager) in 5 of the last 10 years, or
6. all the facts and circumstances indicate that your participation was regular, continual and substantial (this test should not be relied upon)

As a general guide, if you spend less than 100 hours per year managing your forest and if you hire a manager, you will not qualify for active status.

(Note: retired or disabled persons may be exempt from the passive loss rule under Section 2032(a) if their land qualifies as a farm business; they need only be involved in making major decisions.)

Appendix 27 – Measuring Tree Volume

1) Measure the circumference 4 ½ feet above the ground and use the conversion table:

Circumference	Diameter	Circumference	Diameter	Circumference	Diameter
37.75 (3′ 1 ¾″)	12″	66.00 (5′ 6″)	21	100.50″ (8′4″)	32
40.75 (3′4 ¾″)	13	69.00 (5′ 9″)	22	103.50″ (8′7 ½″)	33
44.00 (3′ 8″)	14	72.25 (6′ ¼″)	23	106.75″ (8′10 ¾″)	34
47.00 (3′ 11′	15	75.25 (6′ 3 ¼″)	24	110.00″ (9′ 2″)	35
50.25 (4′ 2 ¼″)	16	78.50″ (6′ 8 ½″)	25	113.00″ (9′ 5″)	36
53.25 (4′ 5 ¼″)	17	81.50″ (6′ 11 ½″)	26	116.25 (9′ 8 ¼″)	37
56.50 (4′ 8 ½′)	18	84.75″ (7′ ¾″)	27	119.25 (9′ 11 ¼″)	38
59.50 (4′ 11 ½″)	19	88.00″ (7′ 4″)	29	122.50 (10′ 3 ½″)	39
63.75 (5′ 2 ¾″)	20	91.00″ (7′ 7″)	30	125.50 (10′ 6 ½″)	40
		97.25″ (8′ 1 ¼″)	31		

2) Measure tree height. Stand 50 feet from the tree. Hold a yardstick upright 25″ from your eye; align bottom end of stick with the bottom of the tree. Without moving the stick, look up and note which inch mark lines up with the merchantable top. On hardwoods the merchantable top is 10″ in diameter or to the first major limb. Each inch on the stick equals two feet of tree height. Round your merchantable height down to the nearest 16 foot log or 8 foot half log. For example, 36 feet is rounded down to two logs (32 feet).

3) Look up volume on following table. Volumes are International ¼ inch rule.

Diameter	1 log	1 ½ logs	2 logs	2 ½ logs	3 logs	3 ½ logs	4 logs	4 ½ logs
12″	56	74	92	106	120	128	137	
13	67	90	112	130	147	158	168	
14	78	105	132	153	174	187	200	
15	92	124	156	182	208	225	242	
16	106	143	180	210	241	263	285	
17	121	164	206	242	278	304	330	
18	136	184	233	274	314	344	374	
19	154	209	264	311	358	392	427	
20	171	234	296	348	401	440	480	511
21	191	262	332	391	450	496	542	579
22	211	290	368	434	500	552	603	647
23	231	318	404	478	552	608	663	714
24	251	346	441	523	605	664	732	782
25	275	380	484	574	665	732	800	865
26	299	414	528	626	725	801	877	949
27	323	448	572	680	788	870	952	1,032
28	347	482	616	733	850	938	1,027	1,114
29	375	521	667	794	920	1,016	1,112	1,210
30	403	560	718	854	991	1,094	1,198	1,306
31	432	602	772	921	1,070	1,184	1,299	1,412
32	462	644	826	988	1,149	1,274	1,400	1,518
33	492	686	880	1,053	1,226	1,360	1,495	1,622
34	521	728	934	1,119	1,304	1,447	1,590	1,727
35	555	776	998	1,196	1,394	1,548	1,703	1,851
36	589	826	1,063	1,274	1,485	1,650	1,814	1,974
37	622	873	1,124	1,351	1,578	1,752	1,926	2,099
38	656	921	1,186	1,428	1,670	1,854	2,038	2,224
39	694	976	1,258	1,514	1,769	1,968	2,166	2,359
40	731	1,030	1,329	1,598	1,868	2,081	2,294	2,494